

REMARKS

The Examiner's Final Office Action of March 13, 2003 has been received and its contents reviewed. Applicants would like to thank the Examiner for the consideration given to the above-identified application.

Claims 1-8 were pending in the present application prior to this Amendment of which claim 1 is independent. By this Amendment, claims 1, 3, 5-8 have been amended. Accordingly, claims 1-8 are pending for consideration, of which claim 1 is independent. In view of these actions and the following remarks, reconsideration of this application is now requested.

The Examiner's indicated allowability of claims 3-8 is withdrawn in view of the newly discovered references to Wang et al. (U.S. Patent No. 6, 1113,685 – hereinafter Wang). For the reasons discussed below, it is respectfully submitted the outstanding rejection of claim 1-8 should be reconsidered and withdrawn.

I. Rejections Under 35 U.S.C. 103(a)

Claims 1-3 and 5-8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Wang in view of Asai et al. (U.S. Patent No. 6,426,519 B1 – hereinafter Asai). As herein amended independent claim 1 is directed to a method of manufacturing a nitride semiconductor substrate, comprising (i) a first step of selectively forming a raised and recessed region in an upper portion of a base substrate; (ii) a second step of growing a semiconductor layer of nitride on said raised and recessed region in said upper portion of said base substrate so that a recessed portion in said raised and recessed region is filled and the upper surface thereof is even; and (iii) a third step of irradiating an interface between said semiconductor layer and said base substrate with a laser beam, thereby separating said semiconductor layer from said based substrate to form a semiconductor substrate from said semiconductor layer, wherein in said third step, the laser beam is irradiated upon said semiconductor layer from the surface opposite to the upper portion of said base substrate, while stress is being generated at the interface between the base substrate and the semiconductor layer.

By irradiating an interface between the semiconductor layer and the base substrate with a laser beam, in accordance with the method amended claim 1, while stress is being generated at the interface between the base substrate and the semiconductor layer, the region near the interface between the base substrate and the nitride semiconductor layer is cracked, and the nitride semiconductor layer can be easily separated from the base substrate. Specifically, the stress generated in the interface between the base substrate and the nitride semiconductor layer is due to the epitaxial growth of the nitride semiconductor layer on the raised and recessed region provided in the base substrate. When the laser beam is irradiated from the surface opposite to the upper portion of the base substrate while stress is being generated at the interface between the base substrate and the nitride semiconductor layer, the distortion in the respective interface of the base substrate and the nitride semiconductor layer is relaxed. As a result, cracking occurs between the base substrate and the nitride semiconductor layer in a direction parallel to the main surface of the base substrate (see Figs. 3B and 5 of the present specification), and thus the nitride semiconductor layer can be easily separated from the base substrate.

Cited reference Wang teaches, as shown in Fig. 1, providing a mask film 11 having an island-shaped opening 13 on the main surface of a sapphire substrate 12 (base substrate), growing a GaN layer 10 on the main surface of the substrate 12 using an epitaxial lateral over growth, and thereafter irradiating a laser beam 14 upon a region, which is in contact with the mask film 11 in the GaN layer, from the surface opposite to the main surface of the substrate 12. However according to Wang, the GaN layer 10 is selectively grown on the sapphire substrate 12 with the mask film 11, which is composed of a material in which GaN is not grown, interposed therebetween. Hence, Wang is different from the present invention, in which the nitride semiconductor layer is epitaxially grown on the raised and recessed region provided in the base substrate.

Also according to Wang, the island-shaped opening 13 is provided in the mask film, in which no nitride semiconductor is grown, and the GaN layer 10 grown from the opening 13 is grown on the mask film 11 in a lateral direction. Since the GaN layer 10 is not epitaxially grown on the mask film, no stress is generated at the interface between the GaN layer 10 and the mask film 11.

Cited reference Asai merely teaches, as shown in Figs. 4 and 5, growing a nitride semiconductor 26 on a sapphire substrate 21, in which top portion a plurality of strip-shaped ditches are provided, but fails to disclose about separating the nitride semiconductor 26 from the sapphire substrate 21. Asai also fails to teach or suggest separating the nitride semiconductor 26 from the sapphire substrate 21 by irradiating a laser beam.

Moreover, Asai also fails to disclose that once a nitride semiconductor layer is epitaxially grown on a raised and recessed region provided in a base substrate, while stress is being generated at the interface between the nitride semiconductor layer and the base substrate.

For the foregoing reasons, combination of Asai and Wang fails to teach or suggest a method of manufacturing a nitride semiconductor comprising, *inter alia*, a step of irradiating an interface between said semiconductor layer and said base substrate with a laser beam, thereby separating said semiconductor layer from said based substrate to form a semiconductor substrate from said semiconductor layer, wherein in said third step, the laser beam is irradiated upon said semiconductor layer from the surface opposite to the upper portion of said base substrate, while stress is being generated at the interface between the base substrate and the semiconductor layer. The combined teachings of Wang and Asai, therefore, fail to present a *prima facie* case of obviousness. Accordingly, it is respectfully submitted that the rejection of independent claim 1 under 35 U.S.C. 103 (a) should be withdrawn. Inasmuch as dependent claim 2 is dependent from independent claim 1, the aforementioned arguments with respect to claim 1 are also applicable to claim 2. Accordingly, the rejection of claim 2 should also be reconsidered and withdrawn.

Independent claims 3 and 5-8 are herein amended to recite, *inter alia*, a third step of irradiating an interface between said semiconductor layer and said base substrate with a laser beam, while stress is being generated at the interface between the base substrate and the semiconductor layer, thereby separating said semiconductor layer from said based substrate to form a semiconductor substrate from said semiconductor layer. Accordingly, for the foregoing reasons, it is submitted that Wang and Asai, taken alone or combined, fail to teach a method of manufacturing a nitride semiconductor substrate comprising, *inter alia*, the step of irradiating an interface between said semiconductor layer and said base substrate with a laser beam, while stress is being generated at the interface between the base substrate and the semiconductor layer, thereby separating said semiconductor layer from said based substrate

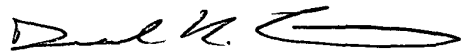
to form a semiconductor substrate from said semiconductor layer, as recited in claims 3 and 5-8. Accordingly, the rejection of these claims under 35 U.S.C. 103(a) should also be withdrawn,

Claim 4 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Wang in view of Asai as applied to claims 1-3 and 5-8 above, and further in view of Sunakawa et al. (U.S. Patent No. 6,348,096 B1). Inasmuch as claim 4 is dependent on claim 3, the foregoing arguments with respect to claim 3 are also applicable to claim 4. Accordingly, the rejection of claim 4 under 35 U.S.C. 103(a) should also be withdrawn.

CONCLUSION

Having responded to each and every rejection set forth in the outstanding Office Action, it is submitted that claims 1-8 are now in condition for allowance. An early and favorable Notice of Allowance is respectfully solicited. In the event that the Examiner is of the opinion that a brief telephone interview will facilitate the allowance of one or more of the above claims, the Examiner is courteously solicited to contact the Applicant's undersigned representative at the telephone number below.

Respectfully submitted,



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